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INFORMATION REPORT

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50X1-HUM

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THIS IS UNEVALUATED INFORMATION

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Introduction

1. Hungary has been a substantial producer of bauxite since 1927 with tonnages ranging from 350 thousand to over one million metric tons annually, depending on political conditions. The 1,050,000 figure attained in 1952 represented over eight percent of world production of approximately 12.8 million metric tons estimated by the Federal Bureau of Mines for that year. /Mineral Industry Surveys, Quarterly Bauxite Report No 30./

2. Reserves of high and medium-grade bauxite amenable to the European Bayer alumina process are estimated at 65 million tons. To this may safely be added 150 million tons of ore too high in silica for economic recovery of contained aluminum by standard Bayer methods. Thus Hungary's probable reserves represent over 13% of the estimated world total of 1,605,000,000 metric tons in 1950 /Materials Survey Bauxite. Compiled for NSRB by US Department of Interior, 1953./ and second only to those recently developed in Jamaica and African Gold Coast deposits.

3. Southern Rumania (formerly Hungarian territory) has limited reserves of bauxite, probably 20 million tons sufficient to supply her 100 thousand annual ton alumina plant now under construction, plus some for export to the USSR. A 35 thousand annual ton reduction works is expected to come into production in 1954. Czechoslovakia produces no bauxite. Production and reserves of other Satellite States are insignificant.

4. Hungary, under heavy Soviet pressure, will have completed during 1953 the integration of her bauxite-lightmetal facilities in accord with the balance shown in Enclosure (B) based on minimum annual production during the remainder of the current five-year plan of one million tons of high-grade bauxite readily amenable to the Bayer process. About one-half of this will be exported to the Soviets. Some 460 thousand tons will be processed domestically into 210 thousand tons of alumina. Of this, 80 thousand tons will be reduced electrolytically to metal in Hungarian smelters, 125 thousand will be exported to the USSR and CSR, and five thousand tons will be consumed domestically in the production of abrasives, much of which will likewise go the the USSR. Again, of the 40 thousand annual tons of ingot produced by Hungary, 30 thousand will be exported to the USSR according to the plan, and domestic mills will fabricate some 10 thousand tons, one-half of

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which is expected to be delivered to the USSR. Thus of the one million annual tons of bauxite, the Soviets will receive in ore, alumina, and ingot and wrought products all but the five thousand tons of semi-fabricated metal products left to Hungarian consumers, equivalent to a little over 20 thousand tons of bauxite or two percent of the tonnage mined. In total, Hungarian mines will thus contribute to the Soviet economy directly or indirectly the equivalent of about 245 thousand metric tons of aluminum, equal to nearly 29% of US production (850,327 metric tons) in 1952.

5. Hungary will have 210 thousand annual tons of alumina manufacturing capacity in three plants, one of which is quite modern. Domestic reduction works have capacity to reduce 80 thousand ton alumina to 40 thousand tons metal using high-cost thermally generated power. Hungarian fabricating works were nominally rated in 1952 at 10 thousand annual tons wrought products, mostly plate, sheet, wire and cable. Tonnages of scrap generated are too small to support an independent secondary smelting industry.

6. Rapid expansion of domestic alumina production up to 400 thousand or 500 thousand annual tons is planned during the next three to five years, much of which will be exported to the Soviet and European Satellite States for reduction at locations more favorably situated in respect to electric power. Plans have also been made at Soviet request to increase Hungary's present 40 thousand annual tons of reduction capacity to 80 thousand or 100 thousand tons metal as part of an ambitious plan to integrate the domestic light-metal industry more completely regardless of the dubious economy of a reduction industry based on high cost electric power. Much of this lightmetal development including power facilities is planned to be concentrated within a five mile radius of Inota /See Enclosure (A)/. The markedly characteristic appearance of these works makes camouflage difficult, therefore, it appears that this concentration of heavy industry will be especially vulnerable to air attack.

7. Hungary's estimated round-figure productions of bauxite, alumina and aluminum are shown in the following table for the years 1947 through 1952. Bauxite in 1953 is expected to reach a minimum one million tons, and alumina and metal should approximate 210 thousand and 40 thousand respectively /as shown in Enclosure (B)./ Increases far above the estimated 1953 level have been proposed but these may not be attained for several years on account of anticipated difficulties attending procurement of metallurgical and power generating equipment. It may also be necessary to abandon the Bayer process for alumina manufacture and develop other methods for treating low-grade bauxite. Details of existing facilities and plans for further expansion are given in other reports of this series describing individual components of Hungary's lightmetal industry.

8. The following table shows in metric tons estimated annual production of bauxite, alumina, and aluminum in Hungary, 1947 through 1952.

Year	Bauxite	Alumina	Aluminum
1947	300,000	35,000	12,000
1948	400,000	40,000	14,000
1949	600,000	50,000	16,000
1950	900,000	80,000	20,000
1951	1,000,000	100,000	22,000
1952	1,050,000	155,000	26,000

Raw Materials for Alumina

9. Deposits of bauxite of economic grade occur in the Transdanubian section of the present-day Hungary, as shown on map /See Enclosure (A)/. In each group underlined below are the villages from which the whole group gets its name.

Gant

Pusztakapolna
Nemetegyhaza
Obarok
Ujbarok

Iszkaszentgyorgy (Underground)

Guttamasi
Isztimer

Halimba

Szoc
Nyirad (Underground)

Eplény

Alsopere
Deaki
Halap

Tapolcza

Diszel

10. Reserves of commercial-grade Hungarian bauxite aggregating about 200 million metric tons are as follows:

(1) High-grade bauxite, above 12 modulus(Proportion of 12 alumina to one silica), /Specification by "modulus" is explained in a subsequent paragraph./
25 million metric tons

(2) Medium-grade bauxite, between 12 and 7 to 1 ratio,
40 million metric tons

(3) Low-grade bauxite, between 7 and 5 to 1 ratio,
120 to 150 million metric tons.

1. The bauxite mines exploited before 1948 are as follows: - Aluminiumercbanya Rt - (Aluminum Ore Mining Company)

Gant	Guttamasi
Pusztakapolna	Isztimer
Nemetegyhaza	Halimba
Obarok	Deaki (no mining - only exploration)
Ujbarok	Halap (no mining - only exploration)
Iszkaszentgyorgy	Tapolca (no mining - only exploration)
	Diszel (no mining - only exploration)

Magyar Bauxitbanyart - (Hungarian Bauxite Mining Co, Ltd)

Nyirad (Underground)

Szoc
Nagy Harsan (Underground)

Bakonyi Bauxit Rt - (Bakonyi Bauxite Co, Ltd)

Epleny
Alsopere

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2. [redacted]

3. Hungarian bauxite ore contains titanium and vanadium in addition to the Al_2O_3, SiO_2, and Fe_2O_3. Specifications for bauxite in the USSR and the Satellite States are based on the relative weight contents of alumina to silica, usually stated as a modulus (ratio). For example, high-grade ore demanded by the USSR must contain not less than 12 units of alumina to one silica, modulus 12; Hungarian plants expect at least 10, and in the future, Czech plants expect to process down to 7-modulus ore. There are no limiting specifications for moisture content; the consumer pays on the basis of dry weight.

4. The following are typical average analyses of Hungarian bauxite. Gant ore is typically monohydrate (boehmite) from open-pit mines; Iszkaszentgyorgy ore is mixture of mono and trihydrates, the former predominating. This is the major future supply and will be from underground deposits.

	High-grade	Gant	Iszkaszentgyorgy
LOI (105°C)	12.9	14.4	20.16
Al_2O_3	55.0	54.4	50.0-52.0
Fe_2O_3	26.0	20.0	17.0 - 19.0
SiO_2	3.2	7.0	5.0 - 6.0
TiO_2	2.9	2.8	2.80
Mn_2O_3		0.14	no data
CaO		0.30	0.37
P_2O_5		0.30	0.38
V_2O_5		0.06	0.06
Modulus, Al_2O_3/SiO_2	17.2	7.8	10.0 - 8.7

Mining Methods:

5. Bauxite in Hungary is mined on a large-scale using up-to-date open-pit methods only at Gant. The other Hungarian mines used, in general, very primitive surface mining methods.

6. Underground mines were operated only at Nagy Harsany and Nyirad where the ore is mined by underground methods from inclined shafts having vertical depths of about 40 to 60 meters. Usually the ore is mined by primitive hand-picks, but in Nyirad some pneumatic tools were in use. Broken ore is selected at the face and hoisted to the surface by motor-driven hoists where hand-operated screens are used to size and sort the ore before transport to the alumina plant of Ajka.

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7. The air compressors and the pneumatic tools are made in [redacted] The domestic industry first began to manufacture compressors during World War II, and pneumatic tools after the nationalization of the industry in late 1948. By that time the embargo was tight enough to stop the import of these tools. There are no mechanical facilities for the t[illegible]port of the

miners; therefore, they must travel on foot to the mines.

18. All ore strata in the Gant area lie at an elevation above that of the surrounding environment (See Enclosure (C)), therefore, all benches are above the level of the main narrow-gauge railroad which connects Gant with Bodajk, a station about 15 km southwest of Gant. In the early days of mining, the extent of the deposits at Gant were not known; therefore, a narrow-gauge railroad was built to connect Gant with the country's broad-gauge railroad system at Bodajk. This made the operations expensive and ineffective on account of the rehandling at Bodajk.

19. Bauxite is mined open-pit from terrace-like benches which are usually about six meters high. During World War II, the Germans provided the mine with Diesel-driven combines [redacted] with which to strip overburden and to mine the ore and load it into cars. Ore is mined without blasting and is loaded in the cars by a rubber conveyor belt attached to the combine. The combine travels on caterpillar treads. These combines are very similar to those used in [redacted] open-pit mines, but are of smaller size. The overall length is 16 to 18 meters. 50X1-HUM 50X1-HUM

20. [redacted] aluminum Ore Mining Company has eight or nine of these excavator-combines, but they are worn-out and often need repairs and their maintenance is difficult [redacted] 50X1-HUM [redacted] Replacements must come from East Germany, and in spite of many promises, equipment was not delivered by the Soviets. 50X1-HUM

21. Overburden also is removed by these excavators. After stripping, the ore is mined in successive cuts until the pit is bottomed. The combine also loads the mine-cars which are of very small capacity, one metric ton. The ore is dumped into small-size [redacted] 50X1-HUM [redacted] bins from which it is drawn and shipped via narrow-gauge railroad to Bodajk as mentioned above. 50X1-HUM

22. In addition to the multiple handlings, another serious handicap is the lack of standardization of equipment. For example, the bauxite mines use cars of one metric ton capacity, and the coal mines use cars of 600 to 640 kilograms capacity of different gauge both in underground and open-pit operations. Such handicaps make maintenance at Hungarian mines expensive compared with [redacted] other European countries. It is astonishing that trucks are not used to haul the ore from the pits to the bins. Re-laying of track is a time-wasting and costly operation. 50X1-HUM

23. The Gant mine has a well-equipped chemical laboratory for the control of the grade of ore; spectroanalytical instruments are used for spot and continous testing of the alumina content of the ore and waste to direct the operations at the different benches.

24. Surface deposits are being exhausted, therefore, bauxite in the future must be mined by underground methods. Preparations for large-scale underground operations were made by the Germans at Iszkaszentgyorgy. In 1944, they stored a large quantity of mining equipment at Iszkaszentgyorgy including centrifugal pumps, electric motors, haulage equipment and pneumatic tools. The Germans, however, shipped a considerable part of this equipment [redacted] 50X1-HUM [redacted] before the end of the war, and the Hungarian Government never recovered it. 50X1-HUM As matters stand, the replacing of this equipment will be very difficult. Efforts are being made to get it under the terms of the Hungarian-Czech Aluminum Agreement.

25. The mines of Iszkaszentgyorgy must take over the role of those at Gant and in the future will account for considerable part of the total domestic production. The ore is about 70 to 90 meters below the surface and water to be pumped is estimated at three to five cubic meters per minute in a medium-size mine. Commercial production will begin in late 1953 or 1954.

26. The so-called "front" method of mining will be employed. The strata are first undercut, then mined with pneumatic tools, picks and shovels. The ore is soft enough so that blasting is required only occasionally. It is believed that the "Ajtay" combine, which was developed in the Hungarian coal mines will be adopted here. It is very similar to the Soviet "Donbas" combine.

27. Unless production methods underground are drastically improved, costs will rise seriously and handicap even more the Hungarian lightmetal industry. The alumina industry is already handicapped by the lack of domestic caustic soda.

Transportation

28. Hungarian alumina factories, except Ajka, are not situated in the neighborhood of the bauxite mines. The ore is transported to the plants in railroad cars. Before World War II most of the exported bauxite went to Germany. Part was transported by barge on the Danube River, and the other part exported by rail, went through the boundary at Hegyeshalom. Barge shipments were loaded into ships at Komarom and Almasfuzito. All bauxite mined in the Transdanubian must be delivered to the Danube River or to the main railroad line at Budapest, Gyor, Hegyeshalom.

29. After World War II the export to Western states [redacted] was completely stopped, and the entire export was shipped to the USSR. This bauxite, which was transpor- 50X1-HUM

to the Soviet Union by barges on the Danube, was also loaded again at Komarom and Almasfuzito as noted above. This waterway goes through Yugoslavia and then to the Black Sea and the Soviet alumina factories. On this route the bauxite must be reloaded, and handling is further complicated by the fact that neither at Komarom nor Almasfuzito are there mechanical loading stations. Designs for those stations were made in 1948, but they were never built. The Soviet Union does not favor this waterway, therefore, it can be assumed that the Soviet Union regards the waterway through Yugoslavia as politically unsafe. The major part of the bauxite for the Soviet Union is now transported by rail through Budapest. There is a well-equipped double track line from Budapest to Cop. Last year in Cop a large transfer station was built for reloading the bauxite from Hungarian railroad cars to Soviet cars, because the track gauge in these countries is different. The entire bauxite export must go through Budapest, because the only railway bridges across the Danube in Hungary are at Budapest. At Dunafoldvar, south of Budapest, is another bridge, but it is for highway traffic only. (This bridge was destroyed by bombs during the war and was rebuilt in 1951.) The original plans were for this bridge to serve a double purpose - railroad as well as highway traffic - but it was not completed as such because at this point on the east shore of the Danube only branch-line railroad connections are available.

30. The following are the railroad lines to the Danube as shown on the map /See Enclosure (A)/

Szekesfehervar - Kapolnasnyek - Budapest

" - Lovasbereny - Bicske

" - Mor - Kisber - Komarom

" - Mor - Kisber Kornye - Banhida

The main railroad line to the West is: Veszprem - Zirc - Gyor. From the main railroad center at Veszprem the route going to the Danube via Hegyeshalom to Budapest is as follows: Veszprem - Varoslod - Devecser - Celldomolk - Papa - Gyor. The most important line handling the Soviet export is the Veszprem - Szekesfehervar route to Budapest. For shipments to the alumina plant in Almasfuzito the most important is the Szekesfehervar Kisber - Komarom. Over this route also bauxite goes to the alumina factory in Magyarovar, because both plants have, in the past, been supplied by the bauxite mines in Gant. Gant has its own private railroad, about 17 km long, which runs from Bodajk to the Szekesfehervar-Mor line. The other lines are only secondary but are very important not only in war emergency but also in wintertime, because most of the bauxite mines are situated south of the Bakony forest, and those railroads which go through the forest are handicapped by the snow.

31. The distances between the bauxite mines and Komarom and the two main alumina plants are as follows:

Gant - Komarom	50 miles
Gant - Almasfuzito	60 miles
Gant - Magyarovar	100 miles

Ground Storage:

32. Until recently all bauxite mines were open-pits. Operation during winter was impossible, so all three alumina factories built large covered storage sheds where bauxite supplies for four to six months could be stored. These shelters are of added value because the natural drying process is also promoted. Although the output of the Almasfuzito alumina factory has been doubled, its storage capacity has not, so the biggest alumina plant now has a shelter where only three-months' reserve of bauxite can be stored.

33. The official mandate issued before World War II was that each factory must have a five-months' reserve of bauxite. During recent years demands for the Soviet export were so enormous that in January 1950, for example, the reserve at the alumina factory in Magyarovar was sufficient only for six days. It was necessary for the government to transfer bauxite from the alumina plant at Almasfuzito.

34. These conditions will soon be changed, because in the future the bauxite mines will not operate open-pit but as underground mines and therefore will be able to operate during the entire winter. This condition will tend to increase the price of the Hungarian bauxite, especially in Ishzkaszentgyorgy, where, in addition to the underground operations, there is the matter of handling mine water. It will be necessary to pump an average of three cubic meters of water per minute from a depth of 100 meters. Because of these factors the manufacturing costs of the bauxite industry will rise, while the quality of the bauxite will be lowered.

Caustic Soda and Lime

35. Hungary at the present time has neither commercial rock salt deposits nor facilities for recovering salt from sea water. It, therefore, has no large-scale factory for caustic soda production although there is a small factory in Budapest, the Hungaria AT. Before and until the end of the war all caustic soda was imported from Germany and Austria.

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The quantities of caustic soda were not very important because until the end of the war only the Magyarovar alumina plant was in operation, and it had a yearly production of only 16,000 metric tons of alumina. After the war and until the nationalization of industry, the Bauxitipar RT made trade agreements and thus obtained caustic soda from Austria in return for exported bauxite or alumina.

36. After nationalization and with the tightening of the embargo, no caustic soda could be imported from the Western States. It could be imported only from the Soviet Union and the Satellites. The exporting countries in the order of their importance are: USSR, Rumania, Poland, and Czechoslovakia. The Soviet caustic soda enters Hungary at the border towns of Zahony - Csop; from Rumania it enters at Biharkeresztes, Lokoshaza; and from Czechoslovakia and Poland at Szob and Somoskoujfalu.

37. All caustic soda which enters the country must be transported through Budapest because it has the only bridge across the Danube connecting the Transdanubian with the other parts of the country. The distances between the above-named railroad stations are as follows:

Budapest - Szob	63 km
" - Somoskoujfalu	135 km
" - Zahony	336 km
" - Biharkeresztes	230 km
" - Lokoshaza	225 km
" - Almasfuzito	101 km
" - Magyarovar	185 km
" - Ajka	150 km

38. During World War II a six-months reserve supply was maintained. Reserve requirements are still the same but the uncertainty of imports frequently reduces the supply to a three-month reserve although all efforts are exerted to buy as much caustic soda as possible.

39. Caustic soda is imported only in steel drums in the form of dry, fused 76% Na_2O strength. Tank cars for liquid caustic are not available. About 300 lb of solid caustic are consumed per st alumina produced.

40. Caustic plus lime may cost as much as US$12 to US$14 per st of alumina. Corresponding soda ash and lime requirements in the US alumina industry based on tri-hydrate bauxite would be about US$3.50 to US$6.00.

Lime

41. Quick lime of good quality is readily available at low cost almost anywhere in Hungary. The supply of suitable limestone is inexhaustable.

Alumina - Process of manufacture

42. All three Hungarian alumina factories located at Magyarovar, Ajka, and Almasfuzito use the same process. 50X1-HUM It was developed in cooperation with the Vereinigte Aluminum Werke (VAW) and is a modification of the Bayer method. The three plants differ only in the size of the machinery and the capacity of the equipment.

43. Bauxite is transported from the mines in railroad cars to the storage bins, where it is stored three to four months. Ore from storage is crushed with rolls and dried usually in revolving kilns in order to promote finer grinding and at the same time completely destroy organic matter. Hungarian bauxite has a high content of organic materials 50X1-HUM After drying, the ore is ground dry to 48-mesh in ball mills, and stored in large storage bins.

44. Bauxite is drawn from storage, and carefully weighed portions are put in the mixers with recycled solvent, hot caustic sodium aluminate plant liquor. The pulp is transferred to the autoclaves where the process of dissolution takes place under closely controlled heating with high-pressure steam and corresponding high temperature. Aluminum goes into solution in the form of sodium aluminate ($Na_2O.\ Al_2O_3$). The other components of the bauxite, principally iron oxides, silica, and titania are, for the most part, not dissolved and remain in the solid residue known as "red mud."

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45. After completion of the decomposition, the content of the autoclaves is discharged to closed vessels for cooling, heat recovery, and dilution with spent plant liquor. The pulp is then delivered to a series of Dorr thickeners for separation of solids from pregnant liquor by counter-current decantation. The red mud in the final thickener underflow goes to "Kelly" filter presses where almost complete separation of red mud and caustic sodium aluminate liquor is affected. The red mud, for the most part composed of ferric oxide, is delivered to the dump, and later shipped to iron smelters for production of sponge iron.

46. The pregnant liquor from the thickener overflows is clarified, diluted, cooled and delivered to mechanical agitator tanks for precipitation. In these, aluminum hydrate is precipitated by hydrolysis with the aid of hydrate "seed", and separated from spent liquor by sedimentation and filtration. The "white mud" hydrate filter-cake is washed, and calcined at about 1400° C to anhydrous alumina, Al_2O_3 in revolving kilns. The spent liquor contains regenerated caustic soda, soda ash and some unprecipitated alumina. The liquor is causticized with lime and evaporated to strong caustic solution to be recycled to the digesters. Spent liquor, before evaporation, has a content of about 17% caustic soda (about 202 gpl NaOH at 60°F). This solution goes to multiple-effect evaporators where water equal to the amount of fresh water added to the system is eliminated and the contents of sodium hydroxide is thereby increased. To this concentrated solvent liquor is added fresh caustic sufficient to replace that lost in the red mud and the fortified liquor containing about 350 g caustic per liter is returned to the autoclaves to begin a new cycle as noted above.

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ENCLOSURE (A)

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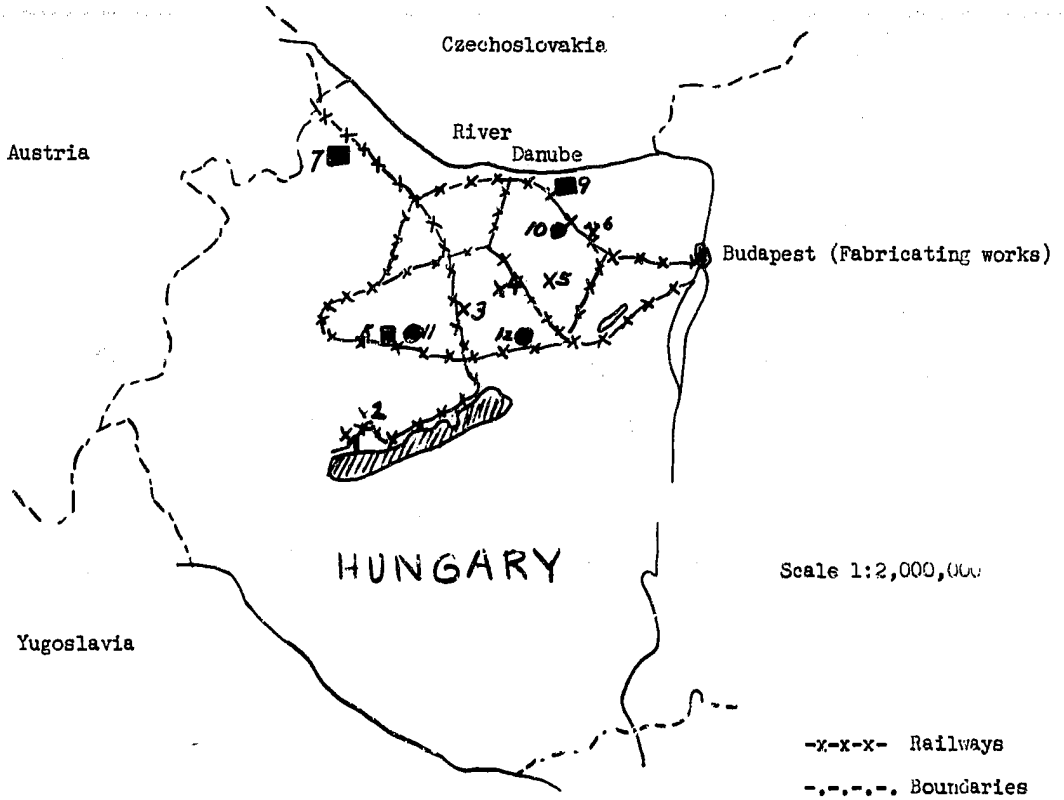
SKETCH MAP SHOWING LOCATION OF HUNGARIAN LIGHTMETAL INDUSTRY



Bauxite Mines x

1. TAPOLCA
   Halap
   Diszel
2. HALIMBA
   Szec
   Nyirad
   Deaki
3. EPLENY
   Alsopere
4. ISZKASZENTGYORGY
   Gutamasi
   Isztimer
5. GANT
   PusztaKapolna
6. UJBAROK
   Obarok
   Nemetegyhaza

Alumina Plants ■

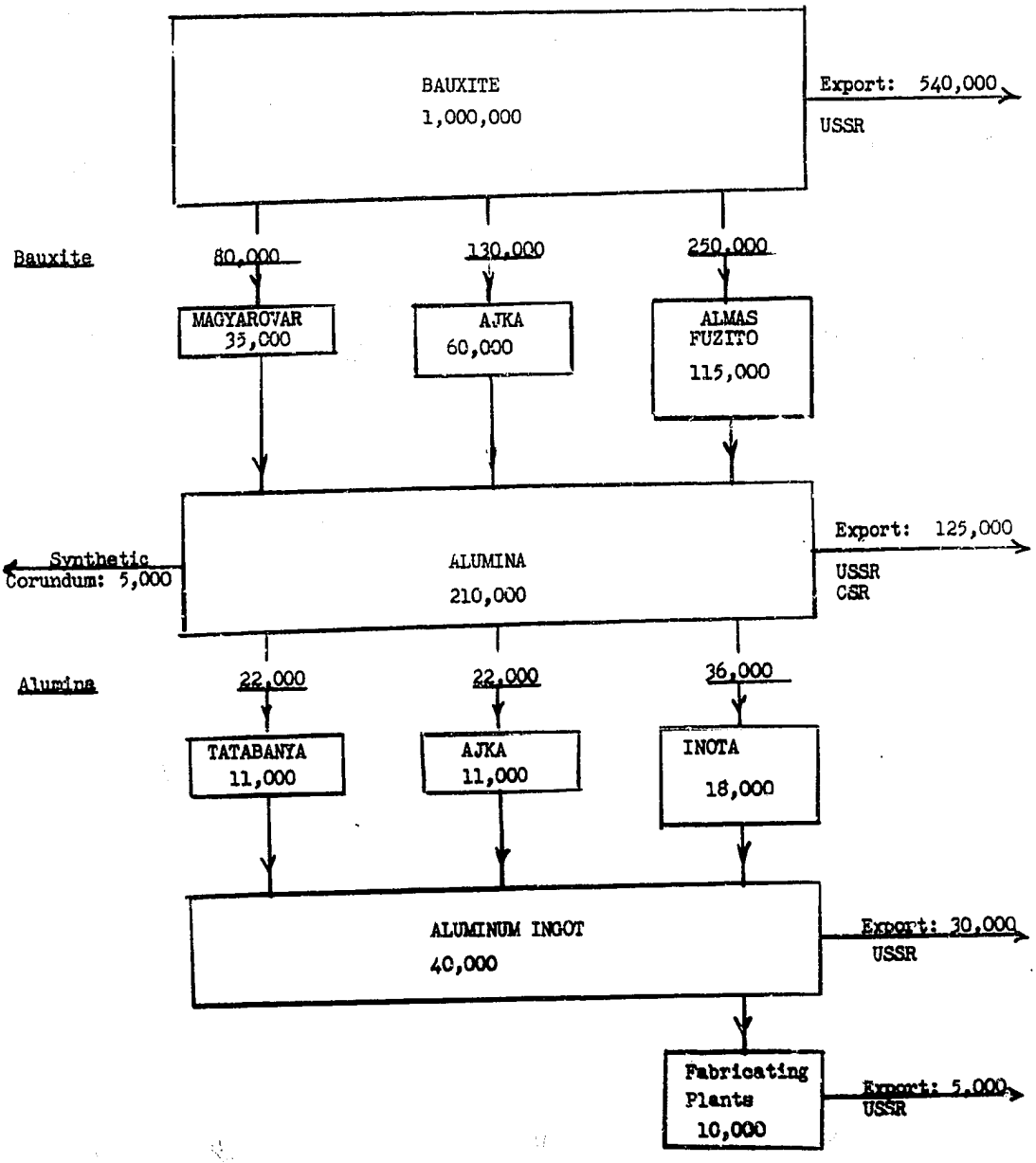
7. Magyarovar
8. Ajka
9. Almasfuzito

Aluminum Reduction Works ●

10. Tatabanya
11. Ajka
12. Inota

ENCLOSURE (B) SECRET/SECURITY INFORMATION 50X1-HUM

DIAGRAM OF THE HUNGARIAN BAUXITE - ALUMINUM INDUSTRY YEAR 1952



All figures metric tons per year.

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ENCLOSURE (C)

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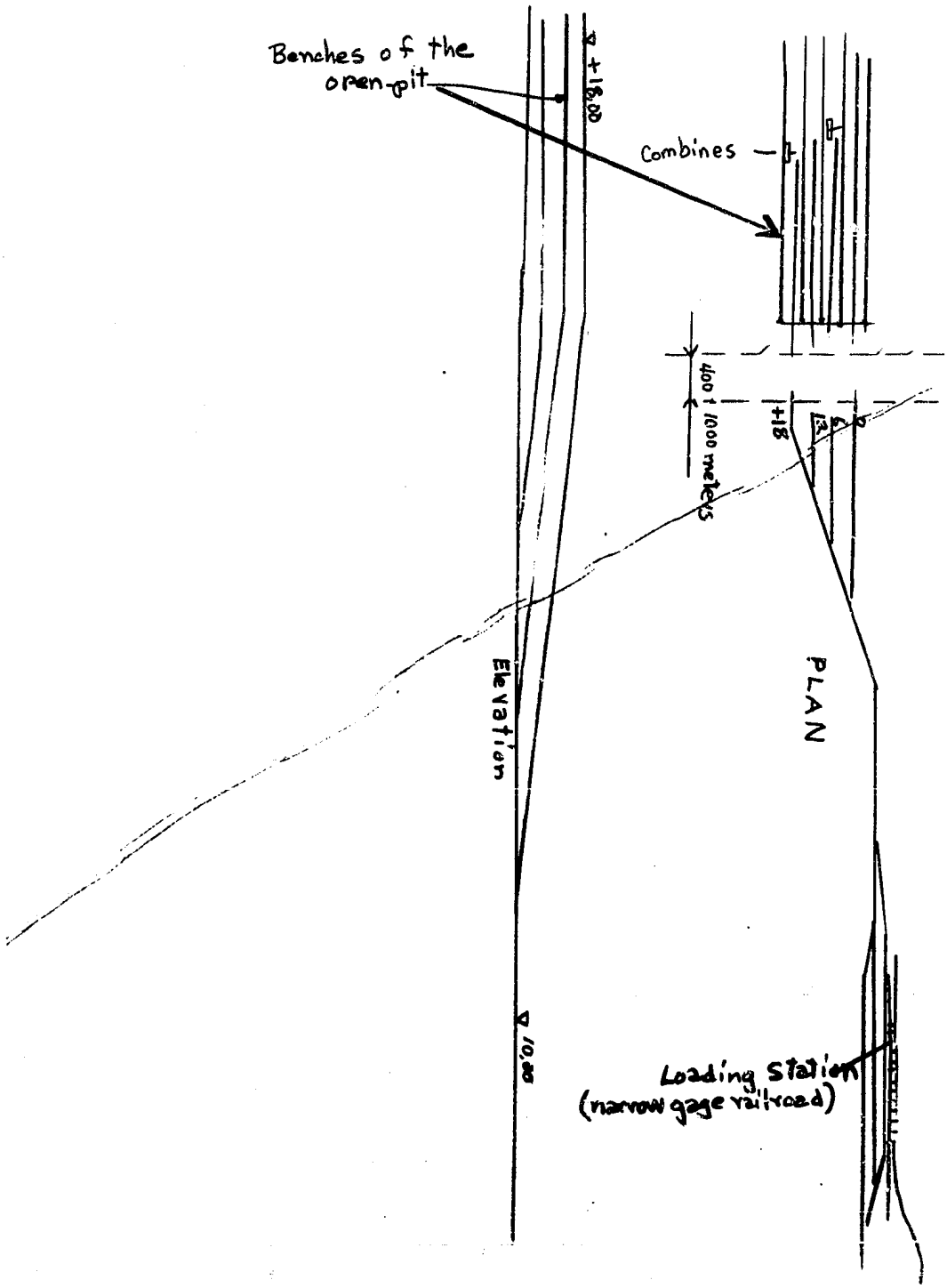
SKETCH OF LAYOUT OF GANT OPEN-CUTS



Scale 1: 10,000